



MISSION OPERATIONS  
AND DATA SYSTEMS DIRECTORATE




CONTROL CENTER OPERATIONS  
AT THE  
GODDARD SPACE FLIGHT CENTER

ROBERT M. CONNERTON  
JUNE 19, 1991

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P-22

MO&DS DIRECTORATE	<div>G S F C</div> <div>  </div>	
CODE 500	<div>CONTROL CENTER OPERATIONS AT GSFC</div>	
<div>AGENDA</div> <div>o BACKGROUND</div> <div>o TECHNICAL CHALLENGES</div> <div>o NEW DIRECTIONS</div> <div>o TECHNOLOGY DRIVERS</div> <div>o SUMMARY</div>		

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## CONTROL CENTER OPERATIONS AT GSFC



### BACKGROUND

- o PRESENTLY OPERATING EIGHT MISSIONS OF VARYING COMPLEXITY IN FOUR DIFFERENT CONTROL CENTERS

- MULTI-MISSION SUPPORT:


- o COSMIC BACKGROUND EXPLORER (COBE)
- o GAMMA RAY OBSERVATORY (GRO)
- o EARTH BUDGET RESOURCE SATELLITE (ERBS)
- o INTERNATIONAL COMET EXPLORER (ICE)
- o INTERPLANETARY MONITORING PLATFORM (IMP)

- DEDICATED SUPPORT:

- o HUBBLE SPACE TELESCOPE (HST)
- o INTERNATIONAL ULTRAVIOLET EXPLORER (IUE)
- o NIMBUS SPACECRAFT (NIMBUS)

- ATTACHED PAYLOAD SUPPORT

- o BROAD BAND X-RAY TELESCOPE (BBXRT)
- o SPACE TEST PAYLOAD (STP)

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CODE 500	<div>BACKGROUND (CONT.)</div> <div> <div>-</div> <div> <div>PLANNED SUPPORT FOR NEXT 12 MONTHS</div> <div> <div>o UPPER ATMOSPHERE RESEARCH SATELLITE (UARS)</div> <div>o EXTREME ULTRAVIOLET EXPLORER (EUVE)</div> <div>o SOLAR ANOMALOUS AND MAGNETOSPHERIC PARTICAL (SAMPEX)</div> </div> </div> </div> <div> <div>-</div> <div> <div>FUTURE ACTIVITY IS A BALANCED MIX OF LARGE OBSERVATORIES AND SMALL QUICK REACTION MISSIONS</div> <div> <div>o DIFFERENT ENVIRONMENTS AND NEEDS</div> <div>o DIFFERENT MISSION DEVELOPMENT LIFECYCLES</div> </div> </div> </div>	

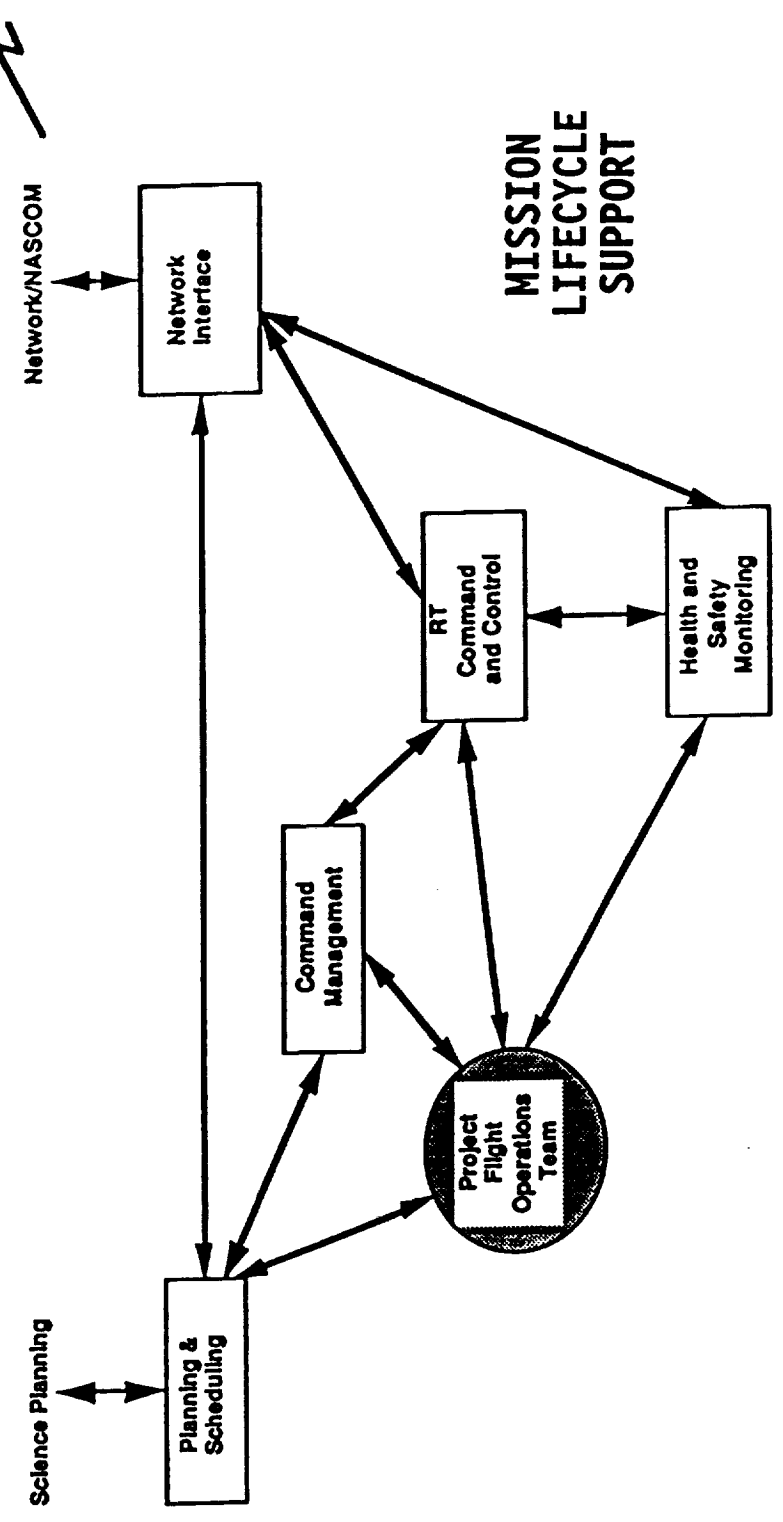
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# CONTROL CENTER OPERATIONS AT GSFC




## MISSION OPERATIONS ENVIRONMENT



## MISSION LIFECYCLE SUPPORT

Engineering		System Development			Test		Transition to Operations		Maintenance	
System	Opns.	Ground System	Facilities	Flight Software	• system • acceptance • end-to-end • readiness		Training, Simulators	Compatibility Testing	-software -hardware -procedures -data	

MO&DS DIRECTORATE	<div>CONTROL CENTER OPERATIONS AT GSFC</div> <div>  </div>	
CODE 500	<div>TECHNICAL CHALLENGES</div> <ul style="list-style-type: none"> <li>o CENTRALIZED MULTI-MISSION POCC's CAN BE QUICKLY RENDERED OBSOLETE BY THE CONFIGURATION CONTROL EFFORTS REQUIRED TO MINIMIZE INTERACTION BETWEEN MISSIONS AND RAPIDLY CHANGING TECHNOLOGY.</li> <li>o THE SCIENCE PLANNING INTERFACE IS BECOMING MORE REAL-TIME, DISTRIBUTED, AND COMPLEX. THIS CREATES SECURITY PROBLEMS (E.G. NASA SCIENCE INTERNET).</li> <li>o USE OF COMMERCIAL SOFTWARE REQUIRES APPROPRIATE PROTOTYPING TO ENSURE SUCCESSFUL APPLICATION.</li> <li>o SMALL MISSIONS ARE FORCING A SHORT MISSION PREPARATION TIMELINE.</li> <li>o OPERATIONAL CONSIDERATIONS ARE POSTPONED UNTIL TOO LATE IN THE MISSION LIFECYCLE.</li> </ul>	

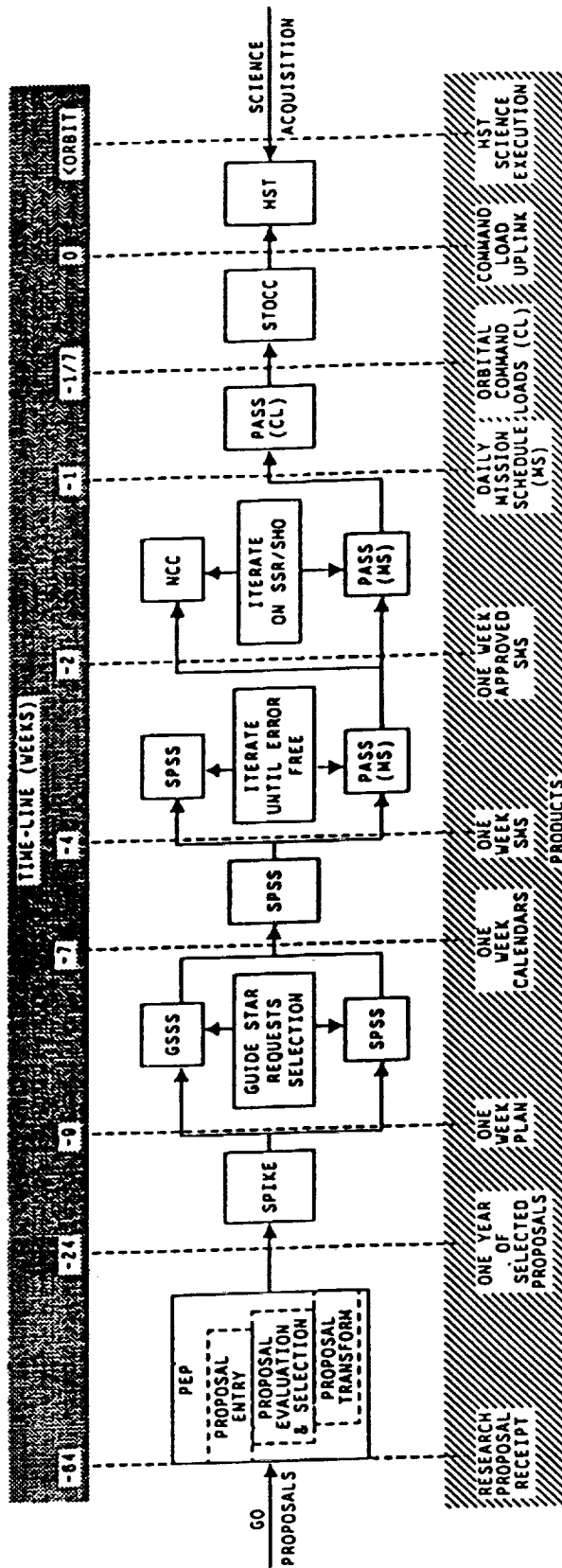
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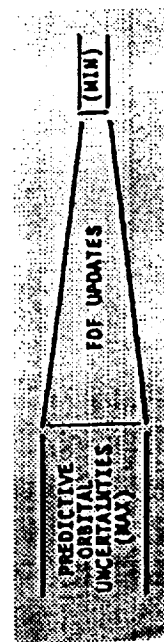
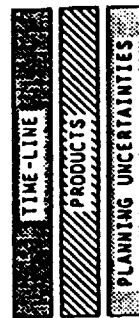
# CONTROL CENTER OPERATIONS AT GSFC




## HST SCIENCE PLANNING INTERFACE



COLOR KEY:



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CODE 500	<div>NEW DIRECTIONS</div> <ul style="list-style-type: none"> <li>o INITIATING OPERATIONS ENGINEERING EFFORT EARLY IN A PROJECT'S LIFE CYCLE: IN PHASE A AND B</li> <li>o UTILIZING MORE COMMERCIAL SOFTWARE <ul style="list-style-type: none"> <li>- X-WINDOWS, MOTIF, UNIX, OSI</li> </ul> </li> <li>o EMPLOYING WORKSTATIONS AS THE FUNDAMENTAL SYSTEM BUILDING BLOCK</li> <li>o EMPHASIZING HUMAN FACTORS IN THE USER INTERFACE</li> <li>o DISTRIBUTING SYSTEMS <ul style="list-style-type: none"> <li>- TRANSPORTABLE PAYLOAD OPERATIONS CONTROL CENTER - SAMPEX, WIND, &amp; POLAR</li> <li>- SUPPORT AND MAINTENANCE SYSTEM - HST</li> </ul> </li> </ul>

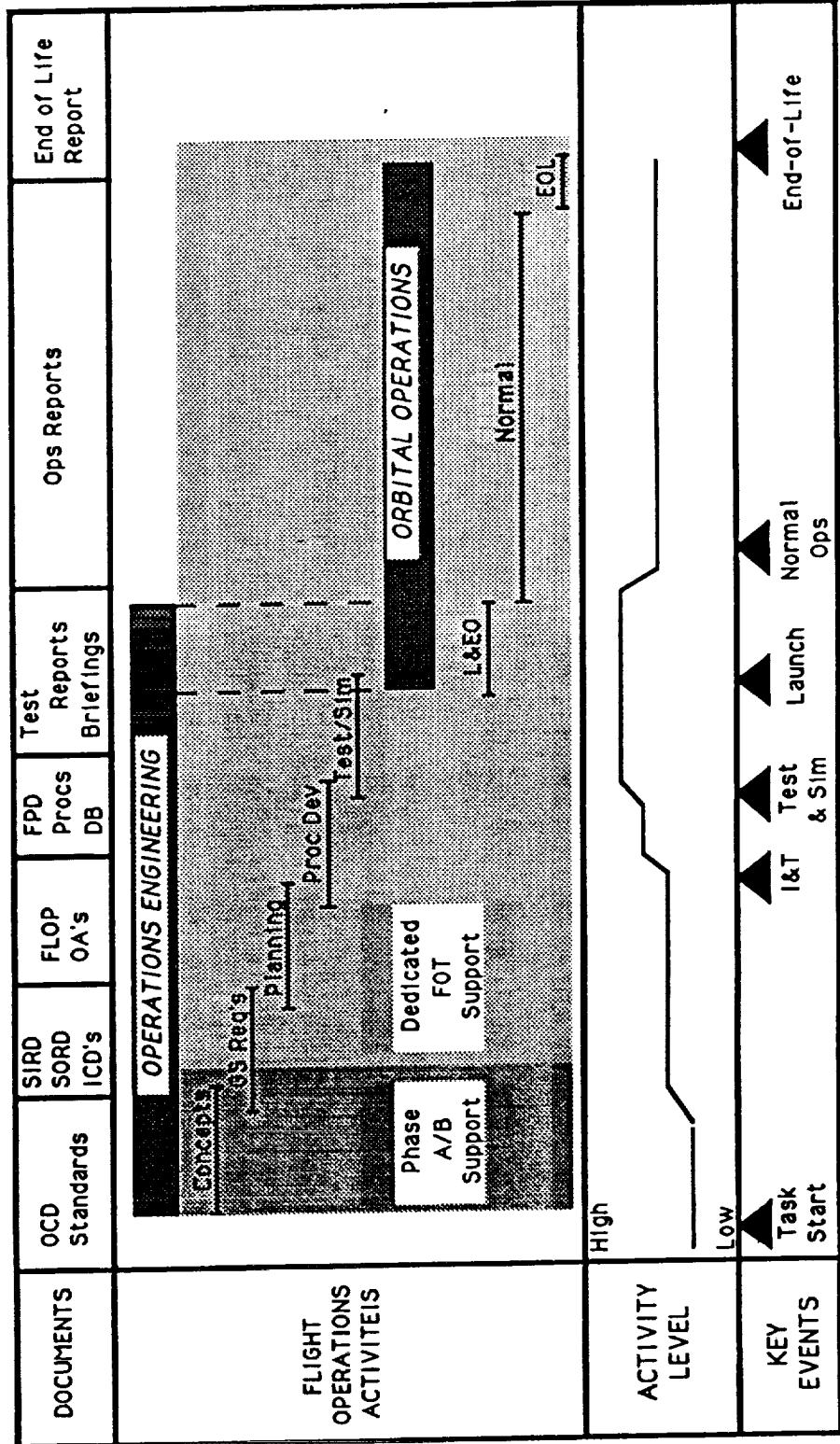
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# CONTROL CENTER OPERATIONS AT GSFC



## Operations Engineering Life Cycle (Mission Operations)



MO&DS DIRECTORATE	<div>  </div> <div>CONTROL CENTER OPERATIONS AT GSFC</div>	
CODE 500	<div>TPOCC</div> <div> <ul style="list-style-type: none"> <li>o GROUPING OF WORKSTATIONS INTO ISOLATED MISSION CLUSTERS               <ul style="list-style-type: none"> <li>- SMALL EXPLORERS</li> <li>- INTERNATIONAL SOLAR TERRESTRIAL PHYSICS SERIES</li> </ul> </li> <li>o SEEKING 60% REUSE OF SYSTEMS SOFTWARE BETWEEN MISSION CLUSTERS</li> <li>o IMPROVED USER INTERFACE THAT IS BASED UPON THE MOTIF SYSTEM</li> <li>o COMBINATION OF COMMERCIAL AND REUSABLE SYSTEM BUILDING BLOCKS</li> <li>o EMPLOYS WORKSTATION ARCHITECTURE ON A LAN</li> </ul> </div>	

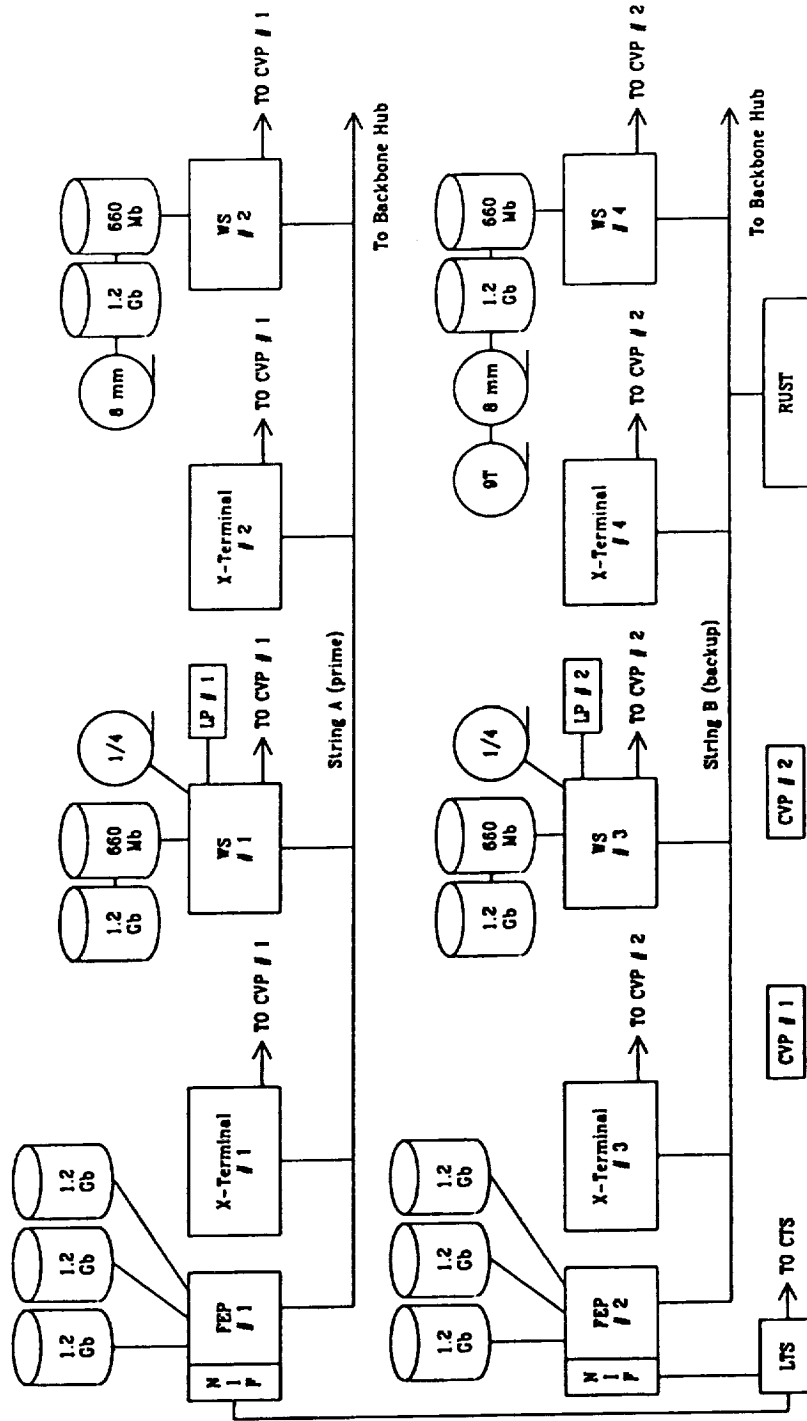
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# CONTROL CENTER OPERATIONS AT GSFC




## TPOCC



### LEGEND:

NIP - Macrom Interface  
 8 mm - 8 mm Helical Scan Tape Drive  
 9T - 9 Track Tape Drive  
 1/4 - 1/4 inch Cartridge Tape Drive  
 LYS - Local TPOCC Switch  
 CTS - Central TPOCC Switch  
 LP - Laser Printer  
 CVP - Video Printer  
 WS - Workstation  
 660 Mb - 660 Mb Hard Disk  
 1.2 Gb - 1.2 Gb Hard Disk

MO&DS DIRECTORATE	<div>CONTROL CENTER OPERATIONS AT GSFC</div> <div>  </div>
CODE 500	
	<div>SAMS</div> <ul style="list-style-type: none"> <li>○ EVOLUTIONARY TRANSITION OF HST POCC PHASED TO HST REFURBISHMENT MISSION CYCLE.</li> <li>○ PLANNED REPLACEMENT OF ALL POCC SYSTEMS WHILE SIMULTANEOUSLY SUPPORTING OPERATIONS AND REFURBISHMENT PREPARATIONS.</li> <li>○ DISTRIBUTED APPROACH BASELINED.</li> <li>○ CAPABILITY TO ISOLATE USER (FLIGHT OPERATIONS TEAM) SOFTWARE FOR SYSTEM INTEGRITY.</li> <li>○ EMPLOYS PROTOTYPE METHODOLOGY FOR SYSTEM DEVELOPMENT.</li> </ul>

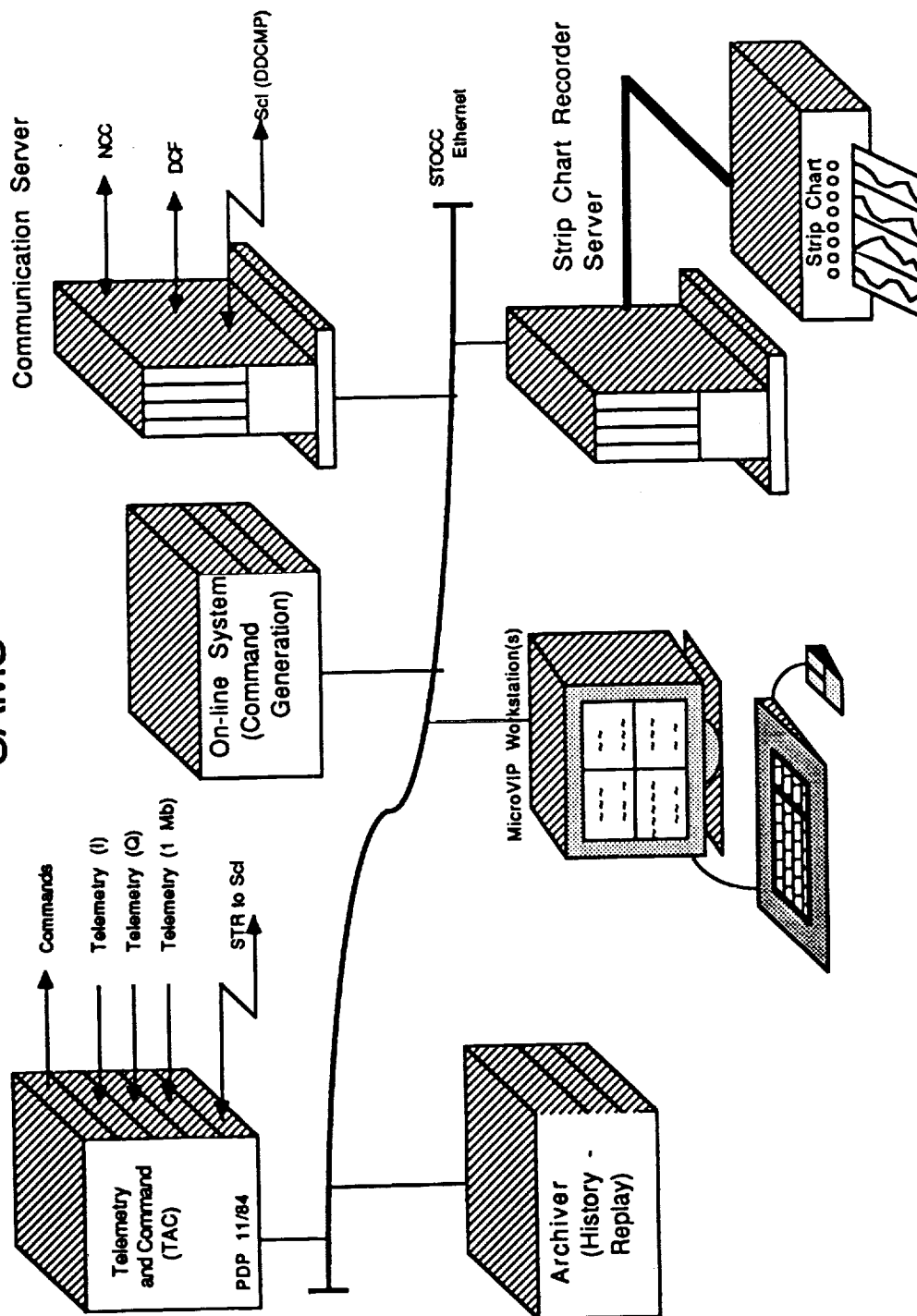
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CODE 500


## CONTROL CENTER OPERATIONS AT GSFC




### SAMS



MO&DS DIRECTORATE	CODE 500	<div> <div>CONTROL CENTER OPERATIONS AT GSFC</div> <div>  </div> </div>
<div>SUPPORT AND MAINTENANCE EXAMPLE</div> <div> <div> <div>o</div> <div> <div>ORIGINALLY</div> <div> <div>-</div> <div> <div>BASED ON HST PORTS SOFTWARE (CENTRALIZED ARCHITECTURE)</div> <div> <div>-</div> <div> <div>DISTRIBUTED FUNCTIONALITY TO MULTIPLE NODES</div> <div> <div>-</div> <div> <div>AUTONOMOUS WORKSTATION</div> <div> <div>-</div> <div> <div>DISTRIBUTED ARCHITECTURE</div> </div> </div> </div> </div> </div> </div> <div> <div>(+)</div> <div> <div>INCREASED COMPUTING POWER</div> <div>FEWER SINGLE POINTS OF FAILURE</div> <div>EASILY EXPANDED</div> <div>SIMPLIFIED MAINTENANCE</div> </div> </div> <div> <div>(-)</div> <div> <div>REQUIRES INCREASED COORDINATION</div> <div> <div>-</div> <div>EVENTS</div> <div>-</div> <div>LIMITS</div> </div> <div>INCREASED COMPLEXITY</div> </div> </div> </div> </div></div></div></div>		

MO&DS DIRECTORATE	<div>CONTROL CENTER OPERATIONS AT GSFC</div> <div>  </div>
CODE 500	
<div>TECHNOLOGY DRIVERS</div> <div> <ul style="list-style-type: none"> <li>o BEGINNING TO APPLY AI TO MISSIONS               <ul style="list-style-type: none"> <li>- CLEAR SYSTEM FOR TDRSS INTERFACE TROUBLESHOOTING ON COBE AND GRO</li> <li>- BCAUS SYSTEM FOR GRO FOR SAFEHOLD ANALYSIS</li> </ul> </li> <li>o IMPROVING THE OPERATION INTERFACE               <ul style="list-style-type: none"> <li>- MAKE MORE FUNCTIONAL</li> <li>- EASIER TO USE</li> </ul> </li> <li>o COMMERCIAL LOCAL AREA NETWORKING TO CONNECT WORKSTATIONS               <ul style="list-style-type: none"> <li>- ETHERNET</li> <li>- MOVING TOWARDS OPEN SYSTEM INTERCONNECT</li> <li>- DEVELOPING NETWORK MANAGEMENT CAPABILITIES</li> </ul> </li> </ul> </div>	

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CODE 500	<div>USER INTERFACE APPLICATIONS</div> <div> <ul style="list-style-type: none"> <li>o GENERIC CAPABILITIES <ul style="list-style-type: none"> <li>- GRAPHIC PAGE DEFINITION</li> <li>- COMBINATION "WILDCARD" AND TREND ANALYSIS PAGES</li> <li>- FLIGHT OPERATIONS TEAM DEFINED DISPLAYS</li> <li>- POINT AND CLICK INTERFACE</li> <li>- EVENT PROCESSING RELATIVE TO POSITION</li> </ul> </li> <li>o SPECIFIC APPLICATIONS <ul style="list-style-type: none"> <li>- FINE GUIDANCE DISPLAY</li> <li>- COMMAND PANEL</li> <li>- GRO ATTITUDE</li> </ul> </li> </ul> </div>	

back-to-front

# COMMAND PANEL for SAMPEL

PROG FIRM NAME - TEST CELL IDENTIFICATION UNIT - TIM LOCK TEL: 0400

PLANNED PROCEDURES  
PROCEDURE NAMES/CONTENTS

PROC 1	30 305 22-10-15
PROC 2	30 305 22-10-15
PROC 3	30 305 22-10-15
PROC 4	30 305 22-10-15
PROC 5	30 305 22-10-15
PROC 6	30 305 22-10-15

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PROC 1 NAME - TEST CELL IDENTIFICATION

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1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

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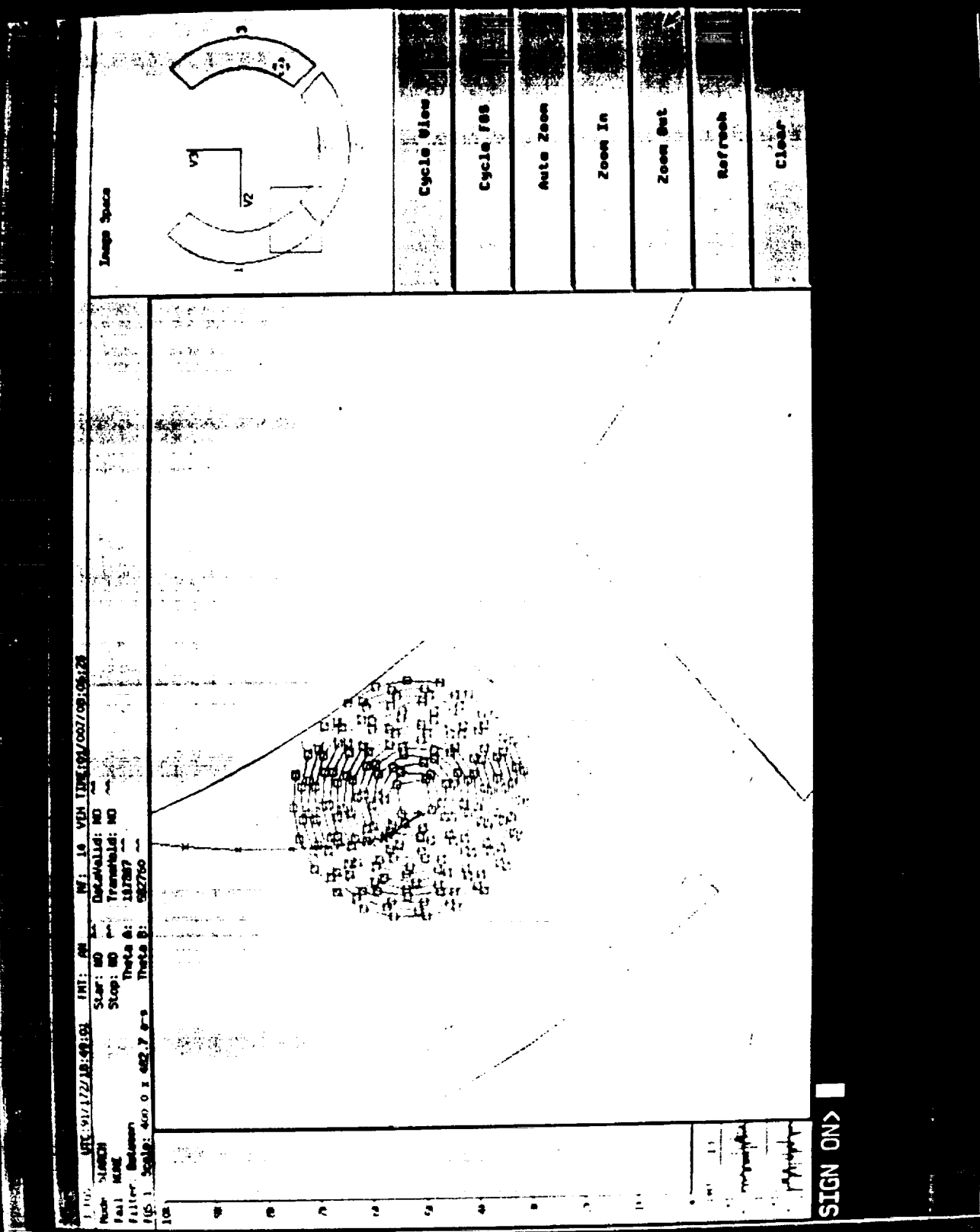
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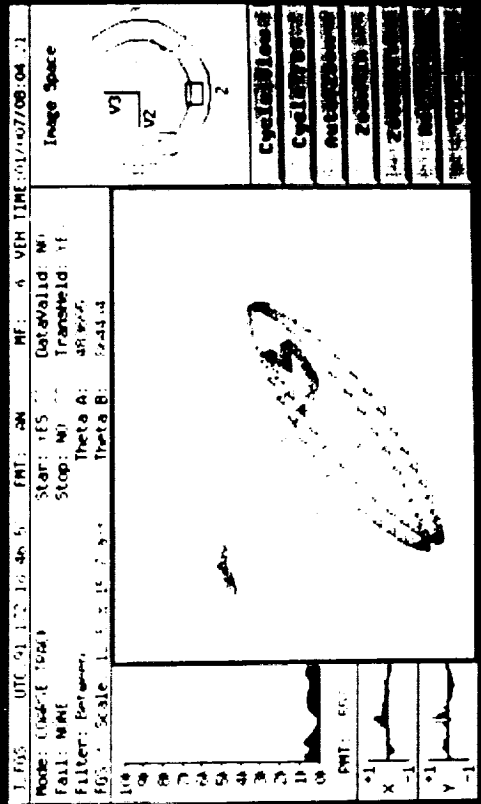
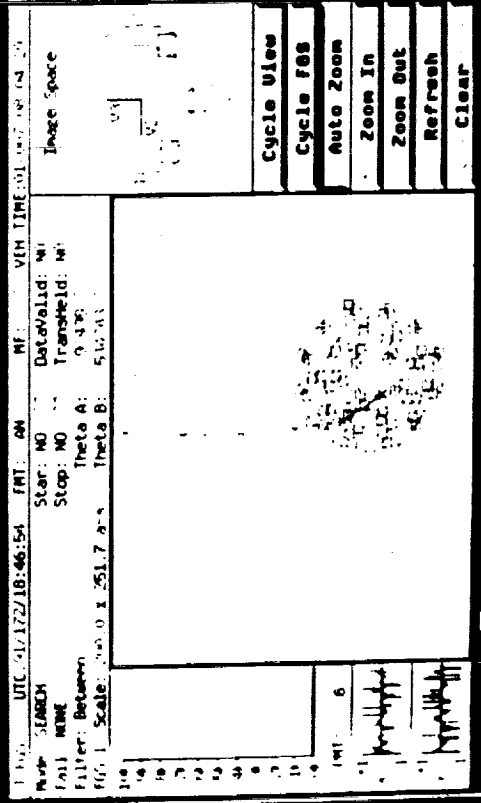
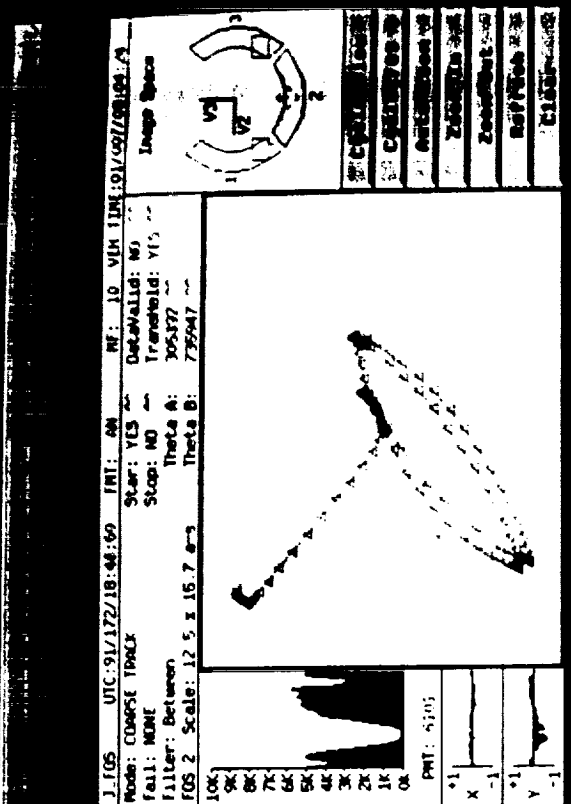
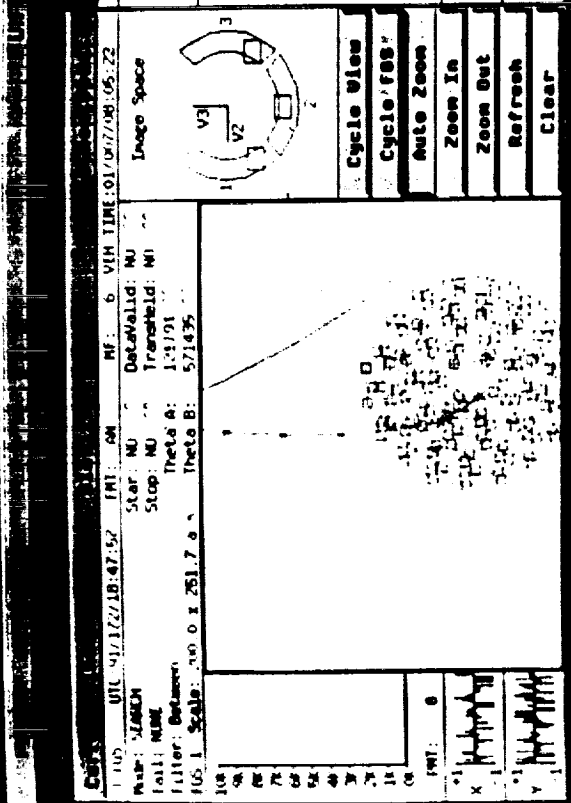
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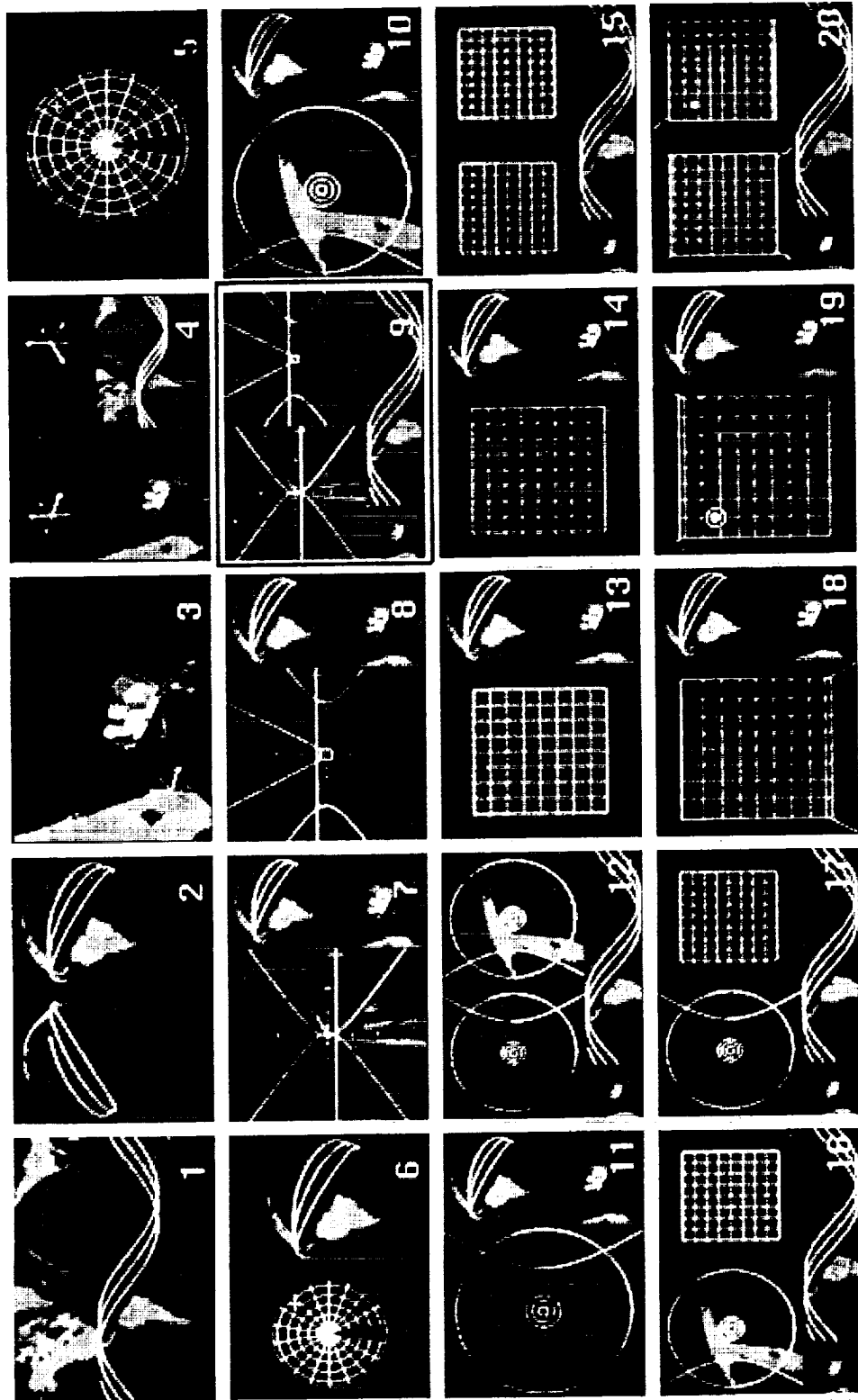
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MO&DS DIRECTORATE	<div>CONTROL CENTER OPERATIONS AT GSFC</div> <div>  </div>	
CODE 500	<div>SUMMARY</div> <ul style="list-style-type: none"> <li>0 SYSTEMS ARE BECOMING MORE DISTRIBUTED</li> <li>0 FORMALIZING THE PROCESS OF OPERATIONS ENGINEERING TO ADDRESS OPERATIONAL ISSUES AS EARLY AS POSSIBLE</li> <li>0 FOCUSING ON GENERIC CAPABILITIES THAT CAN BE TAILORED FOR SPECIFIC MISSION IN ORDER TO SHORTEN DEVELOPMENT TIME</li> <li>0 SUCCESSFULLY HANDLING A DIVERSE RANGE OF MISSIONS</li> </ul>	